Tribhuwan University

Institute of Science and Technology

Discrete Structure

2069

Full Marks : 80

Pass Marks : 32

Time : 3 hrs.

Attempt all questions :

Group A (10*2=20)

1.) Given propositions p and q, define conjunction and disjunction of p and q.

2.) Is the following argument valid?

If taxes are lowered, then income rises.

Income rises .

∴taxes are lowered

3.) Use mathematical induction to prove that $4^n -1$ is divisible by 3.

4.) State and prove “the pigeonhole principle”.

5.) Develop a “general explicit formula” for a non homogenous recurrence relation of the form :

$a_n = rq_{n-1} + s$, where s and r are constants.

6.) Define the terms a language over a regular grammar and a regular expression.

7.) Distinguish between multi graph and pseudo graph with suitable examples.

8.) Let A = {0,1}. Show that the following expressions are all regular expressions over A

a.) 0*(0v1)*

b.) 00*(0v1)*1

9.) Distinguish between undirected and directed graphs with illustrations.

10.) Explain non-deterministic finite state automata.

Group B (5*4=20)

11.) Let S={0,1}. Give the regular expressions corresponding to the regular set given :

a.) {00, 010, 0110, 011110,…..}

b.) {0, 001, 000, 00001, 00000, 0000001,……….}

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12. For the Fibonacci sequence, prove that for $n \geq 2$,

$$f_{n+1}^2 - f_n^2 = f_{n-1} f_{n+2}.$$

13. Define explicit formula for the sequence: $\{a_1, a_2, a_3, \ldots\}$. Write an explicit formula for the sequence 2, 5, 7, 12, 19, 31.

14. Explain the rules of inference for quantified statements.

15. Define isomorphism. Given an example to show that the graphs are not isomorphic.

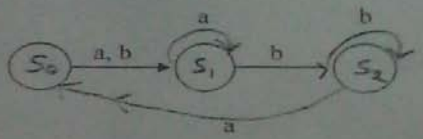
Group C

(5×8=40)

16. Define deterministic finite state automata. When are two finite state automata equivalent? Explain it..

17. Construct the state transition table of the finite state machine whose diagraph is shown:

25 32



18. Construct truth tables to determine whether the given statement is a tautology, a contingency, or an absurdity:

(a) $p \Rightarrow (q \Rightarrow p)$

(b) $q \Rightarrow (q \Rightarrow p)$

(c) $p \wedge \sim p$.

19. A phrase structure grammer G is defined to be a 4-tuple $(V, S, v_0, \mapsto)$, where $V = \{v_0, w, a, b, c\}$, $S = \{a, b, c\}$, $v_0 \mapsto aw$, $w \mapsto bbw$, $w \mapsto c$.

v→s

Derive a sentence of L(G), the language of this grammer.

OR

Prove that an undirected graph is a tree if and only if there is a unique simple path between any two of its vertices.

20. Explain the concept of network flows and max-flow Wincut theorem with suitable examples.

OR

Find a maximum flow in the network shown in the figure.